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THE WHITE-PINE BLISTER RUST.[1]

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INTRODUCTION.

The white-pine blister rust is a destructive disease of the so-called white pines, that is, pines which bear their needles in bundles of five each. It has caused much damage in some of the countries of northern Europe. It is caused by a parasitic fungus (a plant organism) similar in many respects to the fungi that cause wheat rust and cedar apple rust. Like those diseases, it requires two distinct kinds of host plants in order to complete its entire life. These are (1) the 5-needle pines and (2) the wild and cultivated currants and gooseberries.

This serious disease of our white pines came to us from Europe in imported white-pine seedlings. It is now known that comparatively small lots of such diseased seedlings were imported as long ago as 1900, or even earlier; but in the year 1909 immense numbers of such seedlings were brought into the country and were largely distributed before the presence of the disease was discovered. In this way the

[1] This publication is designed to be spread open at the colored plate, so as to serve as a poster when desired.

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disease was introduced into the States of New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, Ohio, and Indiana. The disease is now known to be present in the States of New Hampshire, Vermont, Massachusetts, Connecticut, New York, and Pennsylvania. Owners of planted 5-needle pines in all States should watch for indications of this serious disease.

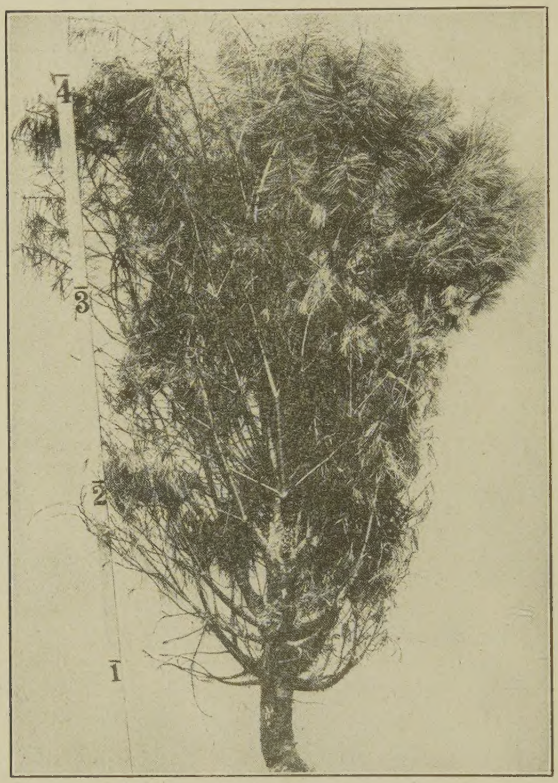


FIG. 1.—White-pine tree about 10 years old dying from the effects of the blister rust. The measure indicates the height of the tree in feet. Just above the 1-foot level is a girdle of dead, cracked bark. Directly above the dead bark are numerous white blisters on the edges of the living bark. The tree is badly stunted in growth. (Photograph furnished by G. C. Atwood.)

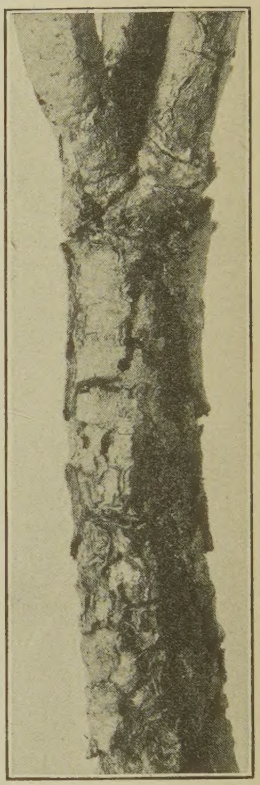


FIG. 2.—Trunk of a white-pine tree about 10 years old which has borne blisters of the blister-rust fungus in previous years. Note the heavy scales of dead bark on a tree which at this age ought to have smooth bark. (Slightly less than life size.)

WHAT TO DO ABOUT WHITE-PINE BLISTER RUST.

WHAT TO DO ABOUT WHITE PINES ALREADY PLANTED.

The white-pine blister rust [1] came into this country from Europe in nursery stock and in no other way. Any white pines, stone

[1] The disease commonly known as white-pine blister rust is caused by a fungous parasite known technically as *Cronartium ribicola* Fischer (*Peridermium strobi* Klebahn).

pines, or other 5-needle pines[1] that were imported from Europe are liable to have the disease.

Therefore, at any time of year—

(1) Find out definitely the source of your pines. Were they raised from seed in this country or bought of some one who might have imported them? Get a definite statement from the man who furnished them to you. If he obtained them from another person, find out from the latter whether he raised them from seed or not. In short, trace your trees definitely back to the nursery where they were grown from seed. Do not accept an evasive reply. If the source of your pines can not be determined or if they prove to have been imported, consider them under suspicion until you can have an expert inspection made. The Bureau of Plant Industry, on application embodying a statement of such facts as are known to the owner or observer, will make an inspection or secure a competent inspection free of charge.

(2) Inform your neighbors about this disease. Find out whether their pines were grown in America or imported. Tell them if you think you see evidences of the blister rust on their trees, and advise them what to do. Diseased trees on your neighbor's land are a source of danger to you. Post this publication in a conspicuous place, such as the railroad station, post office, town hall, and grange hall. Tell your neighbors to ask the United States Department of Agriculture for Farmers' Bulletin 742, if the disease is on their trees or they are interested in it. Secure more copies yourself if they can be well distributed.

(3) If you can not prove that your pines were grown in America from seed, look at all times of the year for dead trees, dead tops, or dead side branches on the pines. If any are found, look for a girdle of dead, cracked bark below the dead part, as shown in figures 1 and 2. If a girdle is found, look for the pycnidial drops on the living swollen bark adjoining the dead portion. (See fig. 3, showing them on a tree not yet girdled.)

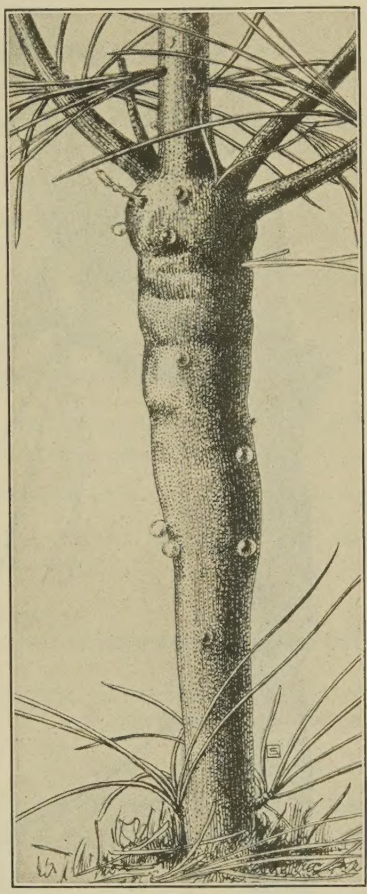


FIG. 3.—A young white-pine tree, showing the swelling and pycnidial drops of liquid caused by blister rust. (Life size.)

[1] The scientific and popular names of the 5-needle pines of the world, exclusive of the different varieties, are here given for the convenience of nurserymen and others who may wish definite technical information: AMERICAN.—*Pinus strobus*, white pine; *P. monticola*, western white pine; *P. lambertiana*, sugar pine; *P. flexilis*, limber pine; *P. albicaulis*, white-bark pine; *P. strobiformis*, Mexican white pine; *P. balfouriana*, foxtail pine; *P. aristata*, bristle-cone pine; *P. cembroides*, piñon pine. FOREIGN.—*Pinus excelsa*, Himalayan white pine; *P. peuce*, Balkan pine; *P. armandi*, Chinese white pine; *P. parviflora*, Japanese white pine; *P. cembra*, stone pine; *P. koriensis*, Korean pine. Some of the more important varieties which are included in the foregoing species are *Pinus nepalensis*, *P. scipioniformis*, *P. mastersiana*, *P. pentaphylla*, *P. morrisonicola*, *P. formosana*, *P. pumila*, *P. mandschurica*, *P. sibirica*, and *P. coronans*.

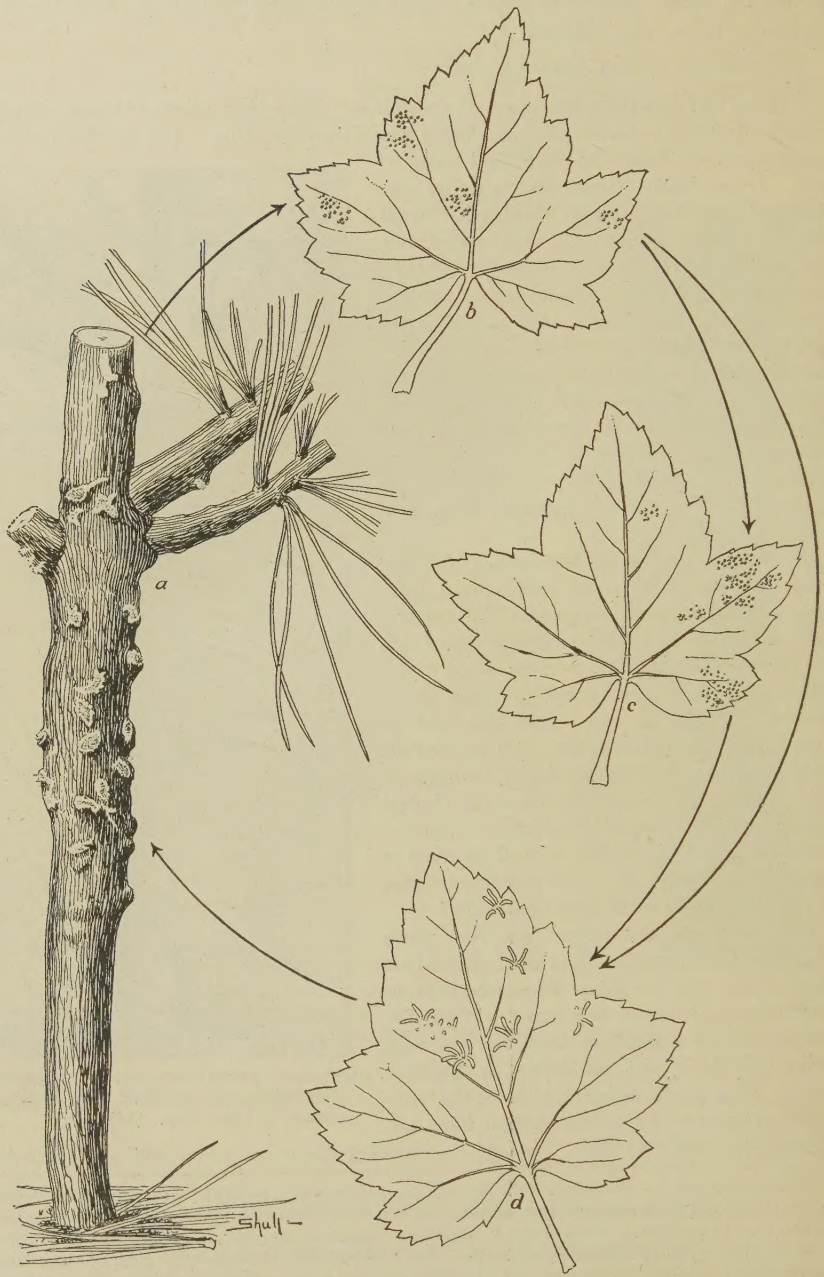


FIG. 4.—Diagram indicating the life circuit of the causal fungus of the white-pine blister rust. *a*, Blisters on pine in May and early June, from which the disease spreads to currant or gooseberry leaves and produces the early summer stage, *b*; thence it may spread to another currant leaf and produce there a second crop of the early summer stage, *c*, or it may produce the late summer stage, *d*; in this stage, in the fall, it infects neighboring white pines, which may or may not include the pine (*a*) which bore the blisters that started the outbreak the preceding spring.

At particular times of the year, look for the different stages of the disease, as follows:

Last of April to middle of June.—Search for blisters on planted pines. (Pl. I, *A*, fig. 1, and fig. 4, *a*).

June 1 to fall of leaves.—Search on leaves of all wild and cultivated currants and gooseberries for the yellow, summer stage of the disease. (Pl. I, *B* and *C*, and fig. 4, *b* and *c*). Pay special attention to cultivated black currants and to the flowering or yellow currant.

August 1 to fall of leaves.—Search on the leaves of wild and cultivated currants and gooseberries for the brown-hair or autumn stage of the disease (Pl. I, *D*, and fig. 4, *d*).

If it is believed that the disease is found, get an expert at once to verify your opinion. Do not destroy trees or bushes until this is done, as such destruction may not be necessary.

When advised by a competent person to destroy certain trees or bushes, do so at once. Delay may mean much more damage. An owner refusing to take the necessary measures to control this disease will be injured first and most severely by the future progress of the outbreak.

HOW TO BUY WHITE-PINE STOCK FREE FROM BLISTER RUST.

Buy 5-needle pine stock only when a written guaranty is furnished by the nurseryman in the following form or its equivalent:

I, ..., do hereby guarantee that the .....
[Name of nurseryman.] [Number of trees.]
trees of ..... pine furnished to ..... were grown under the
[Kind of pine.] [Name of buyer.]
following conditions:

1. They were raised from seed in my own nurseries.

2. My nurseries contain no imported 5-needle pines or imported currants or gooseberries.

3. My nurseries and the neighborhood for 300 yards distant have no white-pine blister rust present now and have always been free from white-pine blister rust on 5-needle pines or on currants or gooseberries.

(Signed) ——— ———.

Such a guaranty will insure the securing of stock free from this disease. Any essential modification of this form will leave loopholes for evading the purpose of the guaranty.

This has absolutely no connection with the usual certificate of inspection made by a State officer. The inspection certificate alone is useless, so far as the blister rust is concerned, as the disease in its dormant stage can not be detected by inspectors.

DANGER FROM THE WHITE-PINE BLISTER RUST.

The white-pine blister rust is a disease which finally kills the attacked trees or parts of trees. If the trees are attacked while relatively young, that is, 25 years of age or less, it is extremely likely that the entire tree will be killed. If the tree is older than this when attacked, branches and possibly the top central shoot will be

killed. Of course the loss of a few side branches is a small matter to an old tree unless it is an ornamental, but if the disease is present in abundance in proximity to such a tree for a number of years, that tree is likely to have every one of its lateral branches, as well as the top central shoot, attacked and finally killed. In this way the disease may kill the largest tree, and such instances are known in certain localities in Europe where this disease is very prevalent. The great damage, then, that the white-pine blister rust is likely to do at first is to young reproduction or to young plantations of white pines. But after it has become well established in any locality there can be no doubt that older and larger trees may be seriously crippled if not killed by it. In Europe, where this disease has been known for 60 years, it has attacked the stone pine, the Himalayan white pine, the Roumelian white pine, the eastern white pine, the sugar pine, the western white pine, and the limber pine. These are all 5-needle pines. Many of the so-called hard pines, having leaves in twos and threes, have been exposed to infection in Europe, but have never taken the disease. This shows that only the 5-needle pines will take it. There are 12 American 5-needle pines and 9 foreign ones. (See footnote, p. 3.) Any of these species may take this disease. The foreign species are of importance, as they may be cultivated in this country for ornamental purposes.

DANGER IN THE EASTERN STATES.

In the Eastern States the danger threatened by this disease is most important with respect to the eastern white pine. It is estimated that the valuation of the present stand of mature eastern white pine is approximately $186,000,000. This pine is of great importance, aside from the value of the present mature stand, because it is used in fully nine-tenths of the reforestation work in the Northeastern States. Moreover, within the area worst affected by the gipsy moth, the forests are being converted into white pine as rapidly as possible, because this species is by far the most valuable one which is not seriously injured by this insect. More than this, the white pine, in many sections at least, is much the most valuable tree now available for future forests. Its loss would be a real catastrophe, for no other tree can take its place.

The crisis with this disease is already upon the Northeastern States. Most serious and extensive outbreaks are known to have occurred in 1915. If not promptly stopped from spreading farther, there will be no hope of coping with it unless public opinion becomes very earnestly aroused in the near future. Complete authority must be given the State officials to compel unanimous action throughout the infected areas, or this disease will surely escape and become a permanent menace to the entire white-pine stand of the northeastern section of

this country. Indeed, if it is not eradicated it will finally spread by natural means throughout the range of the eastern white pine from Minnesota eastward and from Canada to northern Georgia and Alabama.

DANGER TO THE WESTERN STATES.

The white-pine blister rust, however, also threatens two of the most important lumber species of the western forests, namely, sugar pine and western white pine. The mature stand of these two is estimated to be worth $240,000,000. Both of these trees have been seriously attacked by this disease in Europe. They are little grown in the Eastern States where this disease is present; hence, we have absolutely no experience to show what the disease may do in this country to them. Aside from the consideration of the total valuation, these two species reproduce readily, and the prospects are good that they will form a very important part of the future forests of their regions. Any reforestation which may be done within their range is likely to consist largely of these two species.

The limber pine, which is distributed throughout the Rocky Mountain region, is known to take this disease in Europe. It, together with the two above-mentioned pines, would furnish a means for the spread of this disease over the entire Pacific coast and Rocky Mountain regions.

There can be no doubt regarding the danger from this disease if it once reaches the Pacific coast or the Rocky Mountain regions, as it has been found by experiment that the wild currants and gooseberries of these sections are susceptible to the disease. Conditions in the natural forests are such that if the native forest once becomes infected there is practically no hope of controlling the disease there; hence, the outlook is especially grave.

The writer has no positive evidence that the white-pine blister rust has ever been west of Indiana. Imported white pines of suspicious origin are known to have been shipped as far west as Illinois and Minnesota, but not beyond the natural range of the eastern white pine.

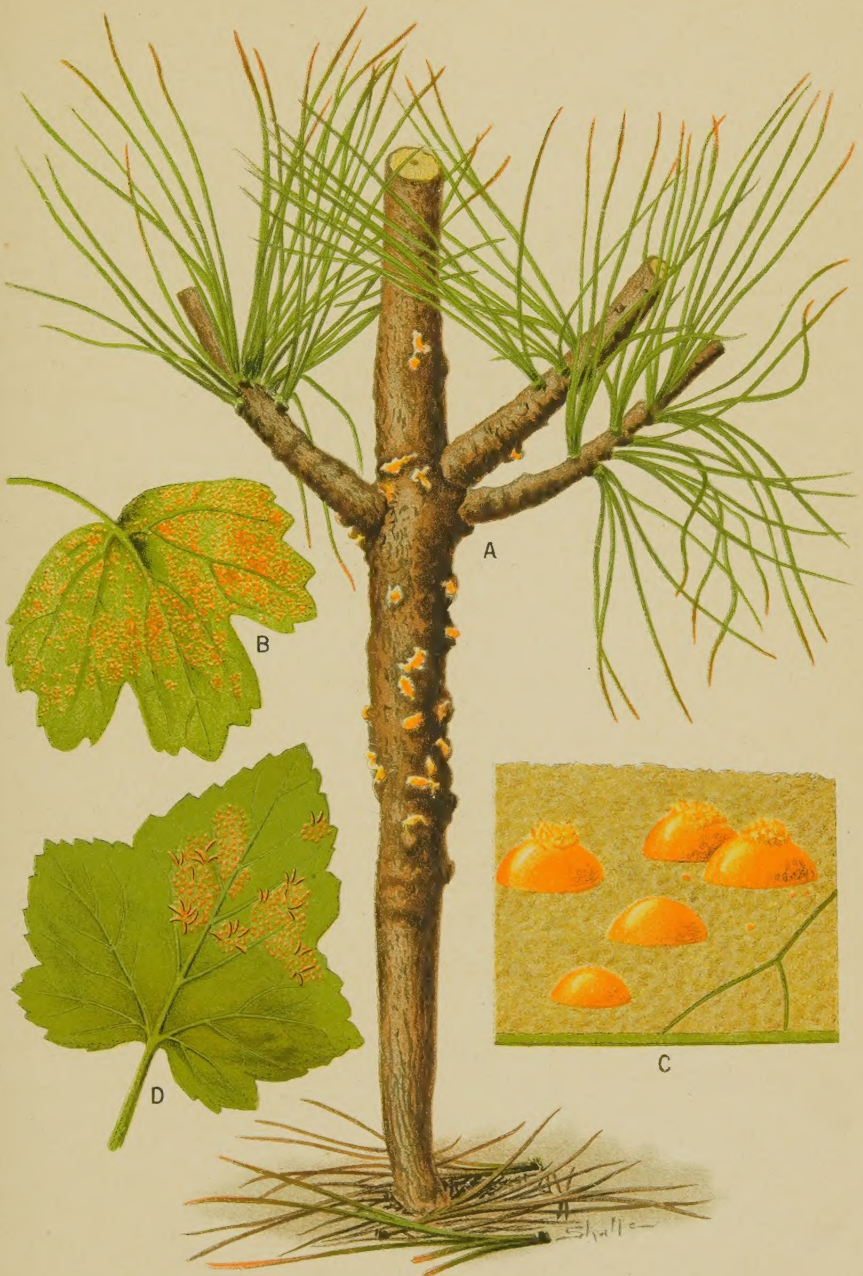
The western forests are so separated from the eastern forests by the arid Great Plains that the white-pine blister rust can reach the former only through the shipment of diseased nursery stock from the East; consequently, the supreme importance of preventing such shipments. All 5-needle pine stock should be grown from seed in the general locality where the trees are to be planted. Each State west of the Missouri River should immediately enforce an absolute prohibition of the shipment of 5-needle pines or of currants or gooseberries from the section east of the Missouri and Mississippi Rivers. Seed may be shipped with entire safety, so far as this disease is concerned. The importance of such State quarantines can not be too strongly urged.

A destructive disease of white pines known as the white-pine blister rust has been introduced from Europe and seriously threatens our white pines. It also attacks the leaves of wild and cultivated currants and gooseberries and spreads for long distances on them. Look for it on pines in May and early June; on currants and gooseberries from June until the leaves are shed. It appears as shown in the colored figures of Plate I.

Explanation of Plate I.—*A*, A diseased white-pine tree with the blisters broken open, spreading the disease to any currants or gooseberries that may be in the vicinity; *B*, early summer stage on the lower surface of a currant leaf, repeating on currant leaves during the rest of the season, a new crop of spores appearing every two weeks; *C*, early summer stage much magnified; *D*, late summer and fall stage on the lower surface of a currant leaf, spreading the disease back to neighboring white pines.

Figure 4 (on p. 4) indicates the course of the disease from pine to currant (*a* to *b*), from currant to currant (*b* to *c* and *d*), and from currant back to pine (*d* to *a*). The complete circuit from pine back to pine takes one year, but the disease may not develop visibly on the newly attacked pine for a period of several years.

Copies of this publication may be secured free, on application to the United States Department of Agriculture for Farmers' Bulletin 742.



A. Hoen & Co. Baltimore

THE WHITE-PINE BLISTER RUST.

Aside from the regions occupied by the four previously mentioned species of white pines, we have the entire remainder of the country in which these species, as well as any other of the white pines, both foreign and American, may be planted as ornamentals. Hence, if the Northeastern States, which do a large proportion of the ornamental nursery-stock trade of the country, become thoroughly infected by this disease, as is sure to happen very shortly if the State authorities are not given complete legal authority for any necessary measures to control it, there is good reason to expect the white-pine blister rust to reach practically all parts of the country where any of the 5-needle pines will grow.

APPEARANCE OF THE DISEASE.

Upon pines the most characteristic symptom is the presence of irregular swellings in the bark. A healthy white pine has a practically uniform diameter throughout the length of each year's growth. A pine affected with this disease is apt to develop a marked swelling at the lower branches if it is a small tree (fig. 5). If a large tree is affected, the smaller branches are apt to show similar more or less irregular swellings. These commonly extend to the bases of smaller side branches and sometimes out into those branches (fig. 5). Sometimes this swelling, instead of showing as a gradually tapering swelling, is very irregular, the bark having a peculiar distended appearance, with rounded swellings located at leaf scars, that is, where a bundle of needles has fallen from the twig (fig. 3). Upon trees only 3 or 4 years of age the disease may cause a shortening of growth and a dwarfing of the top, so that it has an abnormally compact appearance (fig. 1). Upon branches of larger trees this is not usually very evident. Occasionally the leaves upon the affected part of the branch or stem become yellowish, but this is not common. The diseased trunks, branches, or twigs finally die from the girdling effect of the fungus and thus become very noticeable, as they remain upright and do not droop as do twigs affected by frost or by certain insects. Trees up to 25 years of age may have the tops killed in the same way. Do not confuse such dead branches with the work of the white-pine weevil, which is common in many localities. The weevil usually kills only the top central shoot down to the uppermost branches, while the blister rust usually kills side branches or the upper part of the entire top of the tree.

The most certain symptom, however, is that furnished by the fruiting bodies of the parasite, which form upon the thickened bark in the spring from the latter part of April until the middle of June, depending upon the locality and the weather conditions. At first, these thrust themselves from within outward through the swollen bark, in the form of whitish blisters as large as a child's finger nail.

They are usually somewhat longer one way than the other. After a few days the outer membrane, which is white in color, breaks open and the top falls off, exposing the bright-yellow, dusty spores within (Pl. I, *A*). These, after a number of weeks, are completely blown out of the cuplike cavities in the bark. The white membrane sur-

FIG. 5.—White-pine tree 4 years old, showing marked swelling caused by the blister rust. The swelling extends out into the branches. No blisters have yet been produced on this tree. (One-fourth natural size.)

rounding them also disappears, and there remains in the bark merely a rounded hollow, which usually has a whitish, granular appearance within. This is quite characteristic in appearance and, when one becomes familiar with it, is as easily distinguished as are the bright-yellow fruiting bodies themselves. On trees which have been infected when quite young, the disease girdles the main trunk by killing the

affected bark. In such cases the bark becomes scaly, while on the green parts of the tree it is still smooth (figs. 1 and 2). Oftentimes the tree remains alive several years after being completely girdled with the dead bark. In such cases, growth continues above the canker until considerable swelling is produced. The fruiting bodies form each spring, both above and below the dead area in the bark, additional areas of the bark being killed each year (fig. 1). In this way the disease progresses sometimes 2 or 3 feet from its original point of entry.

On currants and gooseberries the parasite is known to attack only the leaves. Here it has two distinct forms, which may occur upon either the currant or gooseberry, or both. The first or summer form is seen on the lower surface of the leaves in the shape of small, mealy, bright-yellow masses hardly larger than a pinhead, which may be very sparse or may be so abundant as to form a continuous, mealy layer over considerable portions of the leaf surface (Pl. I, *B* and *C*). Upon shaking such a leaf, or blowing it, one will perceive a cloud of yellowish powder set free. This form of the disease may be found from the middle of June until the leaves fall, although it is not so common in the autumn as in July or August.

The second or autumn form of the disease upon currant or gooseberry leaves usually is found from the latter part of July until the leaves fall. It occurs in the form of small groups of 3 to 10 or 12 short, hairy outgrowths, scarcely a quarter of an inch long, ordinarily arranged in small circles (Pl. I, *D*). These, like the summer form, may be very scattering on the under surface of the leaf or may be so abundant as to form a hairy coating on the entire lower surface. These hairs are brownish in color, but in moist weather they assume a grayish brown tint. Both of these forms occur upon the lower surface of the leaf, and usually one must turn a leaf over in order to find out whether it is affected or not. While the disease may kill small areas of the upper leaf surface, so that they look brown or yellowish, this symptom can not be depended upon when one is searching for the trouble.

LIFE HISTORY OF THE PARASITE.

The fungous parasite causing the white-pine blister rust is known by two different technical names. The form upon the pine is known as *Peridermium strobi*, while upon the leaves of currants and gooseberries it is known as *Cronartium ribicola*. The latter name is now ordinarily used for the organism, both upon pines and upon currants and gooseberries. The life history of this parasite is very complex, but it is paralleled by a great number of related fungi.

A period of incubation follows the infection of white pines. This period may vary from less than one year up to six or more years, during which time there is absolutely no external indication of the disease. Then the bark begins to swell at the point of infection

(fig. 5). After the swelling of the bark has become apparent upon an infected pine, the healthy green color of the bark on the affected areas is apt to change to a reddish and yellowish color. On the yellowest patches, the parasite pushes forth, through tiny openings in the bark, small drops of a clear, sweet-tasting fluid (fig. 5). This is not pitch. In it, if examined with a microscope, one finds immense numbers of tiny spore bodies. These may be found early in the spring before the formation of the blisters described below, or they may occur apparently at almost any season in late summer and fall. What the function of these tiny spore bodies may be, nobody knows. They occur in a considerable number of closely related parasites, but are not known to reproduce the disease in any way. They are simply indicators of the disease. They are known as pycnospores. Shortly after the pycnospores are produced, from the latter part of April until about the middle of June, the real fruiting bodies push their way through the swollen tissues of the bark until they become visible on the exterior. Here, they first appear like white blisters as large as a child's finger nail. After a brief time, the top of the white membrane breaks loose and falls off. Then it is seen that this membrane surrounds a mass of bright-yellow powder (fig. 1 and Pl. I, *A*). Each grain of this powder is a spore, capable of reproducing the disease. These spores can not, however, infect the pines, but can only attack leaves of currants or gooseberries. After the parasite has fruited once upon the pine, the latter may remain alive until the next year (fig. 1). In most cases, however, the bark is killed completely around the affected part, thus girdling it (figs. 1 and 2). In most cases this means the immediate death of the outer or upper portion of the branch or trunk. Some trees, however, struggle along for a number of years, and sometimes even for 15 or 20 years. In such cases the parasite sends out a new crop of spores each spring to infect any currants or gooseberries that may be in the vicinity. These yellow spores produced in the blisters in the pine bark are known as æciospores, or Peridermium spores.

The Peridermium spores above described are very easily blown about by the wind, and undoubtedly they are distributed mostly in this way. As above indicated, if one of them falls upon a leaf of a currant or gooseberry it is able to attack that leaf (fig. 4, *a* and *b*). There must, however, be present a certain amount of moisture for the spore to germinate. Unless the weather is very dry, the necessary amount of moisture is usually present. In the presence of suitable moisture the tiny spore sprouts somewhat like a grain of corn. It sends its rootlike germ tube into the soft tissues of the currant leaf, and there it spreads within the leaf tissues until it has attained a certain amount of strength and has parasitized a small area of the leaf tissue. Temperature conditions control the rapidity

of this development within the currant leaf. If it is abnormally cold, progress is relatively slow. If the temperature is warm the progress is rapid. With a favorable temperature, it requires 12 to 14 days for the parasite in its new home to produce a new crop of spores. These always appear upon the lower surface of the currant leaf in the form of tiny masses, hardly larger than a pinhead, of fine, orange-yellow powder (Pl. I, *B* and *C*). Each of these masses is the result of an infection of the leaf by a single Peridermium spore from the pine. Naturally, the number of these occurring upon a leaf depends entirely upon the number of Peridermium spores which have stuck to that leaf; in fact, they vary from a single one up to many hundreds on a single leaf. In many cases considerable areas of the leaf surface may be completely covered with the powdery, yellow spores, so plentiful has been the infection. These new spores, very curiously, are quite distinct in appearance from those on the pine from which they originated and are called uredospores. Unlike the Peridermium spores of the pine, which can not reinfect the pines, the uredospores of the currant leaf can reinfect currant leaves. This stage is for this reason called a repeating stage. The uredospores first produced from the Peridermium spores in turn are blown about and fall upon the leaves of adjacent currant or gooseberry bushes and there produce still another crop of uredospores. This repetition may go on all the rest of the season, a new generation of uredospores being produced every two weeks (fig. 4, *b* and *c*). This is the time when the disease spreads most rapidly and to the greatest distances. The progress made at this time, of course, depends entirely upon the presence of some currant or gooseberry bush near enough to the one originally infected so that spores will be blown from the one to the other. In many parts of the country currants and gooseberries are cultivated by nearly everybody who has a garden, and in those sections there usually occur from one to six or eight different species of wild currants and gooseberries in the fields, pastures, and forests; so that a census of the currants and gooseberries in a given locality often shows the best of opportunities for the disease in this stage to spread rapidly and for long distances. This stage of the disease is ordinarily found from June 1 until the fall of the leaves.

From the latter part of July until the fall of the leaves still another form of fruiting body and of spores is produced upon the currant and gooseberry leaves. This may appear upon the same spots which have earlier produced the uredospores, but not always (fig, 4, *b*, *c*, and *d*). The new form appears as groups of 3 to 10 or 12 short, stout threads, not over a quarter of an inch in length and usually arranged in small circles (Pl. I, *D*, and fig. 4). Upon these threads are produced spores of another distinct form. These are known as teliospores. These,

unlike the uredospores, can not repeat their development upon the currant leaves, but in order to carry on the disease they must attack the bark of young white pines or of young parts of old white pines (fig. 4, *d* and *a*). The teliospores, falling upon bark of suitable age on a white pine, may in turn germinate, penetrate the bark, and grow in the inner layers during the incubation period already mentioned. This infection of the pine bark must take place in the late summer or fall. If the parasite finds conditions very favorable, it may produce the sweetish drops of liquid with the pycnospores early the next spring, and shortly after that it may produce the blisters containing the Peridermium spores. The Peridermium stage is visible on the pines from the latter part of April until the middle of June. This completes the life cycle of the parasite. Because of the fact that the Peridermium spores produced upon pine can not infect pine and that the teliospores produced upon currants can not infect currants, we immediately perceive that if the two sets of host plants are separated widely enough so that the spores produced upon one can not reach the other the disease can not spread.

EFFORTS ALREADY MADE TO CONTROL THE WHITE-PINE BLISTER RUST.

In Europe this disease was firmly established before any eradication of plant diseases was attempted, and the only effort there exerted is merely to keep it in check. There has never been, previously, either in Europe or America, any serious attempt to eradicate a disease of trees of this type; that is, we have had no earlier experience with a disease of this sort by which to guide our attempts at controlling this one. It was in 1909 believed feasible to remove all of the diseased trees from an infected lot of pines during the course of two or three years by repeated annual inspections in the spring when the fruiting bodies of the parasite are most conspicuous on pines. The work then attempted was done with this end in view. It has become increasingly evident since that time that such annual inspections would have to be repeated for an indefinite period, as it has been found that the parasite apparently may lie dormant in an infected tree for six or more years before becoming externally visible. This means that inspection is not efficient. The alternative seems to be that of the total destruction of the entire lot of pines known to be infected. In the work done up to the present time, special emphasis has been given to the removal of all wild and cultivated currants and gooseberries from dangerous proximity to lots of pines known to be infected with the white-pine blister rust.

It has been found, however, in these investigations that the various State officials, who necessarily must perform this work, do not have power to destroy such currants and gooseberries as may

seem necessary in order to completely control this disease. The work for this reason has been greatly hampered and in many cases has not been carried out as it should have been. Many people have not realized the seriousness of this trouble, and unanimous action could not be secured. It is absolutely necessary that the State officers have complete power to enforce such measures as are needful for the control of this disease or their work will fail, just as it has failed up to this time.

PRESENT STATUS OF THE WHITE-PINE BLISTER RUST.

During the years 1909 to 1914, inclusive, the white-pine blister rust has been held well in control, considering the circumstances under which the work was carried on. In this period eleven distinct outbreaks of this disease occurred; that is, there were eleven different places where the disease spread from pines to adjacent currants or gooseberries. In these places the disease has been nearly or entirely eradicated. In 1915 the weather conditions were so favorable for the growth of the parasite that it spread very readily on currants and gooseberries for relatively long distances. In 1915 alone twelve distinct new outbreaks occurred. The areas infected vary in extent from only a few currant or gooseberry bushes up to a single area of some 400 or 500 square miles. Unless very energetic action is taken to control the disease at once, it will shortly become impossible to do so.

NEED FOR ADEQUATE STATE LAWS.

As above indicated, there are a number of areas where this disease has spread upon wild and cultivated currants and gooseberries. It is entirely possible to stop its further spread by the mere removal of all wild and cultivated currants and gooseberries within the infected areas. The actual carrying out of this work is not as difficult as is much of the work which is being done in the effort to hinder the spread of other diseases and pests. In carrying on this removal of currants and gooseberries, however, it is absolutely necessary that unanimous action be taken throughout the infected areas. Federal officers have no power to destroy private property in any State. This power is given solely to certain State officers, usually known as State horticultural inspectors. In most cases these State officers do not have power sufficient to compel unanimous action in such removal of currants and gooseberries. This power is one which every State should give to her proper officer at once if this work is to be efficiently done, and if such power is not thus given this serious disease of white pines is certain to escape beyond any possible control and cause irreparable damage.

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